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New Astronomical Data Finds Support in The Nucleon Cluster Model

By Willard D. Nelson*

ABSTRACT

Several teams of astronomers have been using very distant Ia-type supernovas to measure how cosmic expansion may have changed over time. Surprising results now being reported indicate, contrary to expectations based on standard inflation-based big bang scenarios, that the expansion rate is actually speeding up, not slowing down. Given the lack of sufficient observed mass density to close (i.e., "flatten") the universe, some astronomers and cosmologists are now thinking of reviving the theoretical idea of a non-zero cosmic constant, which amounts to finding an expansive energy in the cosmic vacuum or in a hidden antigravity force.

This article points out that a theory of nuclear structure, the Nucleon Cluster Model (NCM) of R. A. Brightsen, includes the description of antimatter nucleons associated with antigravity, as well as the normal association of mass with gravity. Thus, the NCM offers a source of repulsive force and additional mass for use in cosmological models. It suggests a solution to the older problem of "missing matter" and the new problem of "missing anti-gravity."

The Nucleon Cluster Model and its utility is generally described. The NCM by its logic and pattern requires the peaceful coexistence of matter and antimatter nucleon clusters in abundant hydrogen, helium-4 and a few low mass beta-stable nuclides. It also requires the antimatter nucleon clusters to exhibit antigravity effects equal and opposite to corresponding ordinary

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matter clusters in the same low mass nuclei. The NCM then logically predicts its own extension through the "zero mass point" into a symmetric antimatter-antigravity world that, to an earthbound observer, would be equivalent to observed systems and bodies of ordinary matter.

INTRODUCTION

A recent article, "Astronomers See a Cosmic Antigravity force at work," in the journal *Science* [1] describes convincing new evidence that "Seemingly in defiance of (accepted scientific) sense, space itself appears to be permeated by a repulsive force that is counteracting gravity on a large scale". This is the reluctant and shocking conclusion of several teams of astronomers reporting at the Third International Symposium on Sources and Detection of Dark Matter in the Universe, held Feb. 18-20, 1998, in Marina Del Rey, CA. These findings, based on repeated observations of unexpected dimness of very distant supernovas, reportedly have "A statistical confidence of between 98.7% and 99.99% that cosmic expansion is receiving an antigravity boost". Of course, this discovery of an accelerating universe will have a major impact on existing theories of how the big bang "unfolded!"

Earlier observations of very distant "standard candle" (Ia) supernovas had revealed that, if the universe is indeed "flat" (coasting to a stop in infinite time), "matter may account for only 40% to 80% of the critical density, with the cosmological constant (λ) making up the rest" [2]. Previous estimates of the total amount of bright (or observable) mass were only 10% of the critical density, with some type of "dark" matter making up the rest. These discrepancies are characteristic of a theory in development, with specific reference here to the tenuous condition of current big bang theory. This apparently large deficit in mass density has been made up, by theorists, on the assumption that a mysterious background **energy** must exist to fuel the already known expansion rate of the near universe, and it pushes outward against gravity just enough to stop the expansion and close the universe. Now, with an **increased** expansion rate detected, the possibility of an antigravity force operating on a large scale must also be considered. Or, perhaps virtual particle activity of the universal vacuum is accelerating the expansion. Whatever it is, "The new observations could lead to a revised recipe of just what the universe is made of" [3].

This is an exciting time when scientific frontiers are being pushed forward. Theoretical speculation has begun to progress at such a rapid pace that it often outruns experiment. On the other hand, there are areas where experiment is outrunning theory. Examples of the latter are low energy nuclear transmutation (LENT), cold fusion, particle physics—and now cosmologists are again searching for an adequate mechanism to support observations!

THE NUCLEON CLUSTER MODEL

One grand theoretical construction that has both cosmological implications and practical explanations for nuclear experiments, and deserving much closer attention than it has received to date, is the Nucleon Cluster Model (NCM) of Ronald A. Brightsen [4]. It is complex enough that I will not try to describe it in full detail; instead, I refer readers to the references. A first question asked about the NCM, of course, is whether it has a one-to-one correspondence with the Classical Periodic Table of Elements. It does have that correspondence, but it also provides an explanation of the experimentally known stable isotopes of any given element. This new feature and the correspondence with the classical periodic table were succinctly described in a paper first published in *Journal of New Energy* [5] along with a chart, in color, of Brightsen's Atomic and Nuclear Periodic Table of Elements and Isotopes.

This path-breaking work bears on all of the above-mentioned areas of investigation at the scientific frontier, including **prediction of antimatter and antigravity**. Suddenly, the Nucleon Cluster Model is found to support cosmological implications of the above astronomical findings that an antigravity force is accelerating universal expansion.

The NCM took Mr. Brightsen, a retired nuclear chemist, educated at the University of Michigan and MIT, many years to perfect. It is a discovery that the nuclei of all beta-stable atoms, instead of being random mixtures of neutrons and protons, are composed of three types of nucleon subclusters: NP, NPN and PNP, where N represents the neutron and P the proton. These subnuclear cluster identities are found to be maintained throughout the various nuclear decays, fissions, transmutations, transformations and newer processes still being discovered in atomic physics. It implies that the cluster identities have greater binding energy holding cluster nucleons together than attractive energy between clusters.

The germane paper discussing the gravity/antigravity feature of the NCM is Brightsen's "Nucleon Cluster Structures in Beta-Stable Nuclides" [6]. It "discusses the logic of nucleon cluster structures and, especially, negative or antimatter clusters," i.e., how they must push up (↑) against earth's gravity while normal matter clusters push down (↓). Since the overall pattern of the NCM requires antimatter (negative) nucleon clusters coexisting with matter clusters in the nucleus to define the very lightest elements (H, He, ...), the logical assumption is that these negative antimatter clusters (existing stably in the nucleus) **must also exhibit antigravity**. They escape detection in the laboratory because the negative nucleon clusters cancel the gravity mass of equal numbers of (positive) matter clusters in the same nucleus; i.e., the antigravity **strength** of an antimatter cluster is equal to but opposed to that of a corresponding matter cluster.

The model describes a systematic and beautiful pattern of NP, NPN and PNP subclusters that brings complete order and symmetry to the subject of the nuclides. And the pattern includes not just matter as we know it; it extends logically and symmetrically into a "hidden" world of antimatter beyond the zero mass point. Brightsen has now published the new *Atomic and Nuclear Periodic Table of Elements and Isotopes* [7]. Progressively describing each stable isotope of each element in terms of nucleon clusters, this table, and the overall mathematical model it is based on, not only complements but extends and **corrects** both the Z-N diagrams and the Periodic Table of the Elements found in current physics texts. (Orbital electron descriptions per atom are retained implicitly since proton number alone determines the number of electrons associated with each element).

It may be surprising to consider antimatter (-) and matter (+) clusters coexisting in the same nucleus without mutual annihilation; however, Brightsen points out that "In the NCM, independent (unbound) neutrons and protons **do not** exist, and the nature of the mathematical series ... makes it impossible for matter and antimatter clusters of the **identical structure** to exist. Thus, since annihilation can only take place between mirror images (i.e., identical matter and antimatter structures), annihilation cannot take place, only strong attraction" [8].

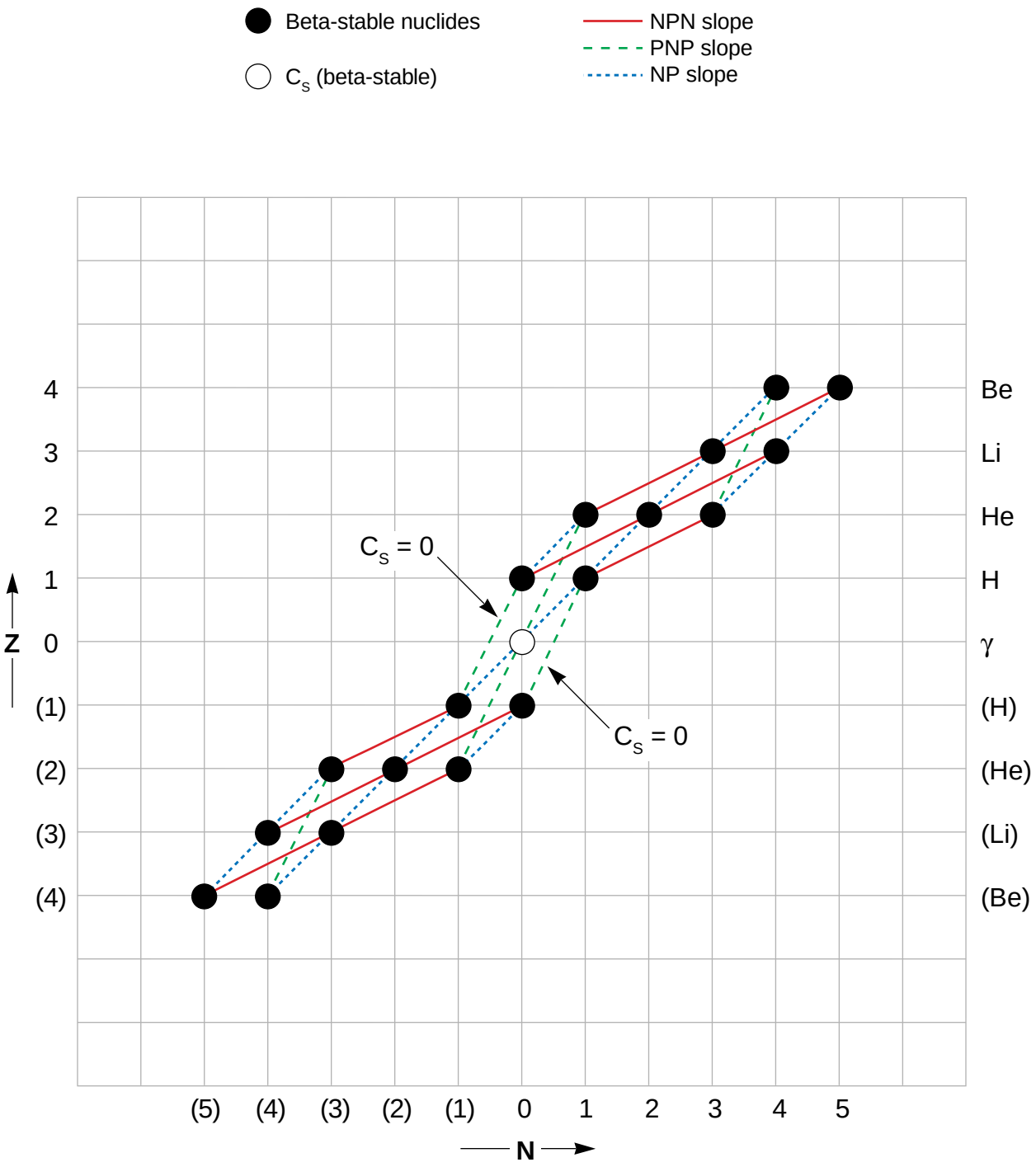
The Antimatter-Antigravity Connection

To my knowledge, antigravity has not been considered by others to be a property of antimatter. If bulk antimatter were observable in the universe outside the laboratory, an antimatter/antigravity association might already have been established by science [9]. As it is, antigravity itself has not been accepted. A reputable dictionary of scientific terms defines it thus: "**Antigravity**. The repulsion of one body by another by a gravitational type of force; this has never been observed" [10]. Perhaps now is the time for the conjunctive association, antimatter = antigravity, to be considered possible, with the NCM as an impetus for discussions.

As already mentioned, the NCM requires in its most simple description of the lowest mass atoms such as hydrogen and helium isotopes, that a certain number of antimatter clusters coexist in those nuclei. These were discovered to be a necessary consistency with the model's description of the great preponderance of other elements with greater mass. What is further described is that these lightest elements, containing antimatter clusters, transition negatively from positive mass greater than one, through zero mass into an increasingly negative universe of undetectable "shadow matter" which is merely the "negative" version of the "positive" universe of the Nucleon Cluster Model's construction. This is best illustrated by **Figure 1**, which has been duplicated here with Mr. Brightsen's kind permission from his basic paper [11]. This depicts a

Figure 1

Mass-Charge Symmetry System for Region 6 ($C_s = 0$)



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portion of the proton-neutron (Z-N) diagram which displays radial symmetry about a "zero point" where both Z and N equal zero. This portion of the so-called "valley of stability" extends from positive Z,N into -Z,-N, and then on into still more negative territory, mirroring the matter world. Here is a source for the dark matter discussed by theorists.

A Diversion Into Details

A striking feature of the NCM is that any beta-stable nuclide is not describable by a unique set of nucleon clusters, due to the absolute equivalence 3NP ≡ 1NPN + 1PNP (i.e., 6 individual nucleons equal 3 nucleons plus 3 nucleons, whether each type of cluster is positive or negative). This potential source of confusion when studying the NCM is relieved by use of the organizing equation:

$$(NP + NPN) + 2(PNP) = Z, \quad (1)$$

where Z is the number of "net positive charge" protons in a nuclide. Standard nuclear physics "assumes" Z is composed of only (+) protons; however, equation 1 arithmetically handles both negative and positive clusters, correctly defining cluster patterns for each stable nuclide. Thus, Z becomes negative on the other side of the mass-charge zero point in **Figure 1**.

The standard atomic mass number, A, must also be conceptually modified to become the "effective mass number" (A_{eff}) to account for the "extra" numbers of (-) antiproton-antineutron clusters in the light elements. This is where the net effective mass/weight is a result of antigravity associated with anti-matter clusters cancelling the weight effect of equal numbers of positive gravity clusters in a nucleus.

Tables 1 and **2** are constructed using equation 1 to determine several possible cluster configurations of hydrogen ($_1H^1$) and helium-4 ($_2He^4$), respectively. A boxed outline is drawn around the simplest NP, NPN, PNP configuration (with the lowest cluster count, Σ_c) for matter and antimatter versions of each nuclide. Note that effective mass number (A_{eff}) of each nuclide remains the same, except for sign, on either side of the zero mass-charge origin. Table 1 also indicates, with dashed arrows, the "path of β-stability," diverging at the right from hydrogen to higher positive mass nuclides and lower negative mass antinuclides. Note also that as the cluster count increases for each configuration (or "isodyne") the actual number of nucleons per nuclide (Σ_n) increases accordingly.

Table 2 shows the simplest cluster configurations for $_2He^4$. It is notable that the lowest cluster count configuration for helium-4—also known as the alpha particle—consists of just 2 NP

Table 1. Hydrogen and Antihydrogen at the Origin

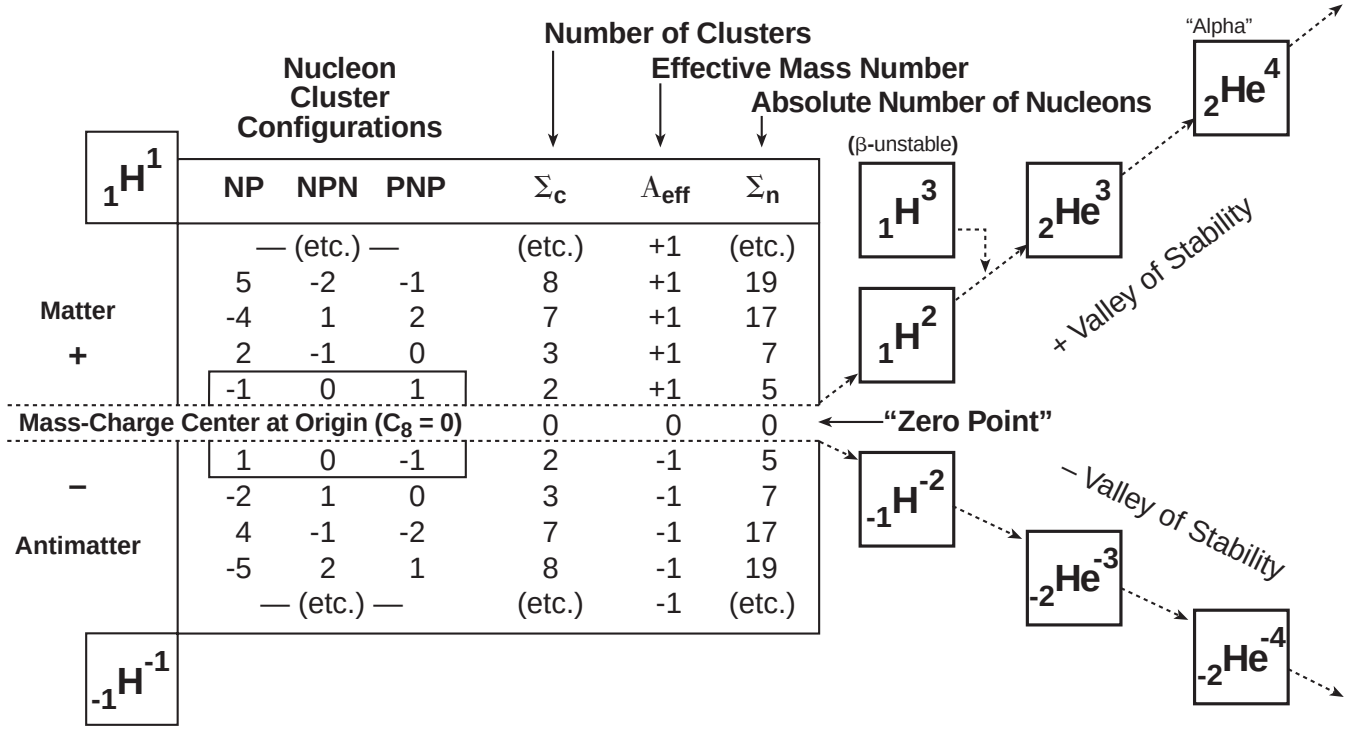
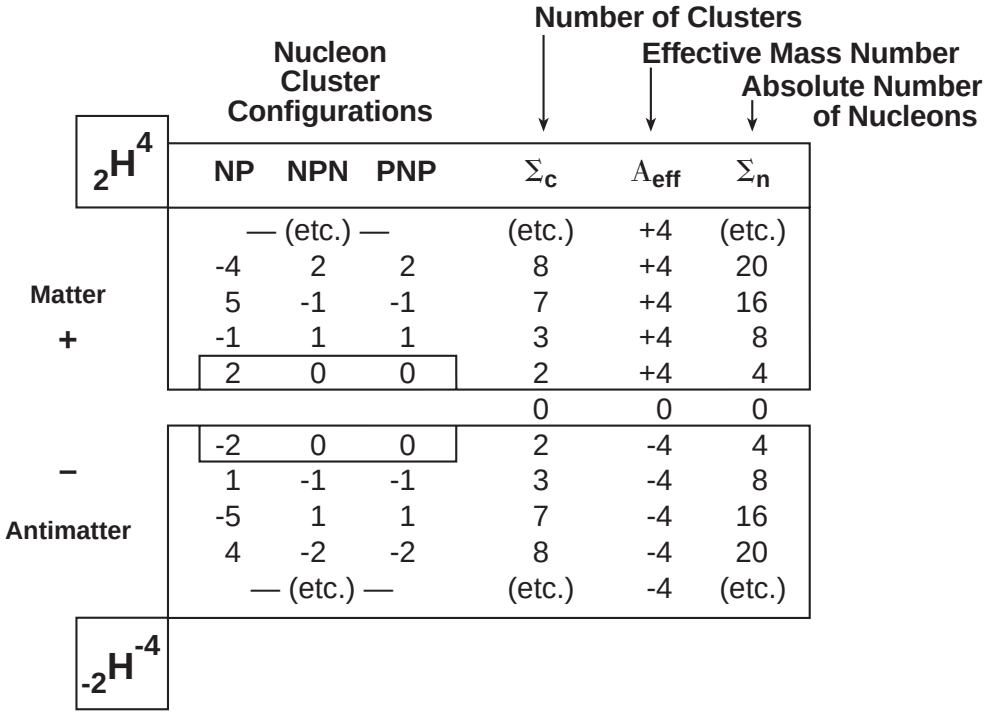


Table 2. Helium-4 Cluster Configurations

(The Alpha Particle)


Number of Clusters
Nucleon Cluster Configurations
Effective Mass Number
Absolute Number of Nucleons
$_2H^4$
NP NPN PNP Σ_c A_{eff} Σ_n
— (etc.) — (etc.) +4 (etc.)
-4 2 2 8 +4 20
5 -1 -1 7 +4 16
-1 1 1 3 +4 8
2 0 0 2 +4 4
0 0 0
-2 0 0 2 -4 4
1 -1 -1 3 -4 8
-5 1 1 7 -4 16
4 -2 -2 8 -4 20
— (etc.) — (etc.) -4 (etc.)
Matter
+
–
Antimatter
$_{-2}H^{-4}$

clusters. One of the basic notions of radio-active alpha decay theory says an alpha may exist as an entity within a nucleus, and the particle "is almost invariably emitted because of its high binding energy" [12]. So with regard to NP and 2NP clusters, already standard theory partially supports the NCM notion of separately identifiable nucleon clusters and qualitatively different levels of binding energy in nuclides (as distinct from nucleon energy levels defined in the theoretical Shell Model).

The Cosmology Question Again

The Science article [1] did not speculate what kind of "hot dark', "cold dark" or shadow matter could be the source of the verified universal repulsive force. Because both matter and energy can curve spacetime, some at the meeting said a mysterious energy, rather than missing "dark" matter, was the culprit beefing up the Einstein cosmological constant (termed lambda). That background energy would push, rather than pull, and speed up cosmic expansion over time. The study results imply that the universe contains roughly twice as much energy in the cosmological constant as in matter.

It may not be just background energy causing increasing expansion. Those scientists seem to discount the possible presence of bulk antimatter which would add mass back into the picture because antimatter—or dark matter itself—has yet to be detected by observations of the universe. In laboratories on earth, negatively charged antimatter particles can be created and then observed. And, some high altitude balloon-borne experiments detect a few positrons and anti-protons in energetic cosmic rays, but no heavier antinuclei [13].

Current theories of the big bang say antimatter disappeared by annihilation reactions during the first moments of "expansion" of the universe and that only some positive (observable) baryonic matter survived. Unobserved antimatter, as a substantial constituent of all matter, as asserted by Brightsen's NCM, could provide at least some of the missing mass density and repulsive force to open the universe, or at least keep it geometrically flat. Calculation of the amount of antimatter available per the NCM has not been accomplished, to my knowledge. Qualitatively it appears that there could be at least twice as much "NCM" mass density as now observed to contribute toward a cosmic constant (lambda) required to match the new observations that trouble cosmologists.

Concluding Remarks

A feature of Brightsen's Nucleon Cluster Model not adequately discussed in this article, but of importance to experimental results, are the alternative descriptions of each nuclide—here called "Isodynes." This term, isodynes, was first suggested by Dr. R. W. Bass in a paper [14] describing successful application of the NCM to determine the novel photon-induced process by which a nuclear transmutation of mercury-201 to gold-197 was observed in an experiment by Lin and Bokris [15].

Another application of the NCM to the field of nuclear physics, in general, and low temperature transmutations/low energy reactions in particular, was seen in the explanations of transmutation of palladium isotopes to seven lower mass nuclides as measured in experiments of Dr. Wolf and presented by Dr. Passell at a conference in Monaco [16].

Additional information about the NCM and the Clustron Sciences Corporation, headed by R.A. Brightsen, may be found on the Internet at:

http://www.gslink.com/~ncmcn/Clustron/

With Mr. Brightsen's permission, I will include his list of *Attributes of the Nucleon Cluster Model (NCM) and the Periodic Table of Beta-Stable Nuclides* as found on his internet site, identified above.

1. Provides a detailed explanation of fission (U-235, Pu-239, Pu-241)
2. The Periodic Table of Beta-Stable Nuclides:
   a) is systematic, symmetric and periodic, and includes all beta-stable nuclides
   b) explains "missing" Z and N values in standard Z,N plot
   c) confirms "magic" neutron numbers (20, 50, 82, 126)
   d) provides strong evidence that the proton contains antimatter, in the form of antimatter clusters
3. Explains production of radioactivities in cathodes
4. Explains origins of excess heat in "cold fusion"; accounts for all observed phenomena (neutrons, tritium, helium-4; absence of high-energy gamma)
5. Accounts for "missing mass" problem in cosmology, by the mechanism of antigravity
6. Predicts (and requires) the existence of antigravity
7. By supporting antigravity, confirms the age of the universe as ≈16 billion years
8. Predicts a method for remediation of radioactivity in nuclear waste; provides a process for conversion of Pu-239 to U-235
9. Conforms with the classical Periodic Table of Elements (Mendeleev, 1869)

There is one additional "claim" I would add to those of Brightsen's list: There is still a **hidden world of symmetry** left in cosmological processes after the big bang—and the NCM reveals it. It lies in antimatter isodynes of hydrogen and other low mass elements as well as negatively beyond the zero mass "Center of Mass-Charge Symmetry" at the origin of both mass and antimass in the model (**Figure 1**). The NCM suggests that a hidden world of symmetry has just not been available to our senses or measuring instruments. Faced with the astounding regularity and logic of the Nucleon Cluster Model, science must devise experimental means either to refute or verify the reality of these preferentially bound nucleon clusters in nuclei of atoms.

Help in finding the "missing matter" of cosmology may now be on the way. Newly announced computer simulations by Ostriker and Cen [17] show that "the primordial clouds (of the early universe) condensed over time into a vast filamentary network of fully ionized plasma which now links galaxies and galaxy clusters." This baryonic plasma, heated at present to about a million degrees kelvin, gives off only a faint x-ray glow that is extremely difficult to detect with present satellites. Says the article, "Soon-to-be launched x-ray satellites should be able to see the plasma". And one x-ray observer (Q. Daniel Wang) has announced that he "may already have seen a hint of these hot filaments." If the existence of this warm and widely dispersed baryonic plasma is verified, it can also be used by theoreticians to validate new aspects of nucleogenesis that would explain the nucleon cluster patterns of the Nucleon Cluster Model[18]. Meanwhile, the NCM will be justified in practise by its use to explain experimental results.

References and Notes

1. James Glanz, "Astronomers See a Cosmic Antigravity force at Work," *Science,* Vol. 279, 27 Feb. 1998, pp. 1298-1299.
2. James Glanz, "New Light on fate of the Universe," *Science,* Vol. 278, 31 Oct, 1997, pp. 799-800.
3. John Noble Wilford, "Wary Astronomers Ponder an Accelerating Universe," *New York Times*, Science section, 27 Feb. 1998.
4. R.A. Brightsen, *The Nucleon Cluster Model and The Periodic Table of Beta-Stable Nuclides,* Published by Clustron Sciences corporation, 4500 South Four Mile Run drive, Suite 804, Arlington, VA 22204. Phone (703) 845-8531.
5. R.A. Brightsen, "Correspondence of the Nucleon Cluster Model With the Classical Periodic Table of Elements," *J. New Energy,* Vol. 1 No. 1, 1996, pp. 75-78.
6. R.A. Brightsen, "Nucleon Cluster Structures in Beta-Stable Nuclides," *Infinite Energy,* Vol. 1, No. 4, Sept./Oct. 1995, pp. 55-56.

7. This 11x17 inch color chart, entitled *Atomic and Nuclear Periodic Table of Elements and Isotopes (Based upon the Nucleon Cluster Model of the Atomic Nucleus),* is published by Clustron Sciences Corporation, address and phone number above, in Reference 4. Please enquire about price and current availability. [Published in book format in Ref. 5.]
8. *Ibid., Infinite Energy,* v. 1, No. 4, p. 56.
9. Note: The term "bulk antimatter" is used here to designate bound clusters consisting of antineutron and antiproton combinations allowed by the Nucleon Cluster Model. These must be differentiated from the rare individual positrons and antiprotons observed from collision of high energy cosmic rays with molecules of the earth's atmosphere. See "Cosmic Antimatter," *Scientific American,* April 1998, pp. 36-41. The observed high energy antiparticles, positrons and antiprotons, are thought to originate with supernova explosions accelerating interstellar protons or heavier nuclei that collide with other interstellar particles. The article concludes that it is unlikely that heavy antiparticles or antinuclei will be found. The bulk antimatter can, of course, be manifested in various astronomical systems and bodies. To the earthbound observer these would appear to be identical to equivalent systems and bodies of ordinary matter.
10. *McGraw-Hill Dictionary of Scientific and Technical Terms,* 5th Edition, McGraw-Hill, Inc. (1994).
11. *Ibid.,* Brightsen, Ref. 4, Figure 8.
12. Arthur Beiser, *Concepts of Modern Physics,* 2nd Ed., McGraw-Hill Book Co. NY, 1973, pp. 396-398.
13. G. Tarle and S.P. Swordy, "Cosmic Antimatter," *Sci. American,* April 1998, pp.36-41.
14. Robert W. Bass, "Experimental Evidence Favoring Brightsen's Nucleon Cluster Model," *Infinite Energy,* Vol. 2, No. 11, Nov./Dec. 1996, pp. 78-79.
15. G.H. Lin and J. O'M Bokris, "Anomalous Radioactivity and Unexpected Elements as a Result of Heating Inorganic Mixtures," Second Annual Conference on Low-Energy Nuclear Reactions, *J. of New Energy,* vol. 1, no. 3 (1996), pp. 100-105.
16. R.A. Brightsen, "Application of the Nucleon Cluster Model to Experimental Results" and "General Explanation of Radioactivities Reported by Dr. Wolf as Described by Dr. Passell (EPRI) at Monaco" (two papers), *J. of New Energy,* vol. 1, no. 1 (1996), pp. 68-74.
17. James Glanz, "Cosmic Web Captures Lost Matter," *Science,* Vol 280, 26 June 1998, pp. 2049-2050.
18. Note: If the warm intergalactic baryonic plasma is confirmed and it can be shown to exist and cool to form neutron-proton and antineutron-antiproton couplets and triplets coexisting in harmony, then the formations and isodynes of abundant hydrogen, helium-4 and other light elements as defined by the NCM can be validated.